

WHAT IS CLAIMED IS:

1. A method for producing metal/metalloid oxide particles comprising rare earth metals, the method comprising reacting a reactant stream in a gas flow, the reactant stream comprising a rare earth metal precursor and an oxygen source wherein the reaction is driven by energy from a light beam.
2. The method of claim 1 wherein the light beam is an infrared laser beam.
3. The method of claim 1 wherein the reactant stream comprises an aerosol with droplets comprising metal solutions.
4. The method of claim 3 wherein the metal solutions comprise non-rare earth metal ions and rare earth metal ions.
5. The method of claim 3 wherein the solution are aqueous solutions.
6. The method of claim 3 wherein the solution comprises nitrate ions.
7. The method of claim 3 wherein the solution comprises ammonium ions.
8. The method of claim 1 wherein the reactant stream comprises a non-rare earth metal/metalloid precursor.
9. The method of claim 8 wherein the rare earth metal oxide particles comprise rare earth doped metal oxide particles.
10. The method of claim 8 wherein the rare earth metal oxide particles comprise a stoichiometric amount of rare earth metal.
11. The method of claim 1 wherein the oxygen source comprises O₂.

12. The method of claim 1 wherein the reactant stream comprises a non-rare earth metal/metalloid selected from the group consisting of aluminum, manganese, silver, yttrium, zinc, magnesium, vanadium, silicon, boron, strontium, and barium.
13. The method of claim 1 wherein the rare earth metal comprises europium, cerium, terbium, gadolinium, thulium, praseodymium or erbium.
14. The method of claim 1 wherein the reactant stream further comprises a non-metal composition that absorbs infrared light.
15. The method of claim 1 wherein the resulting metal/metalloid oxide particles have less than about 10 mole percent of the metal being rare earth metal.
16. A method of making a collection of metal/ metalloid sulfides particles with an average particle size of less than about 500 nm, the method comprising contacting metal/metalloid oxide particles with H_2S at a temperature below the melting temperature of the metal/metalloid oxide particles and the metal/metalloid sulfide particles, wherein the metal/metalloid oxide particle have an average particle size under 500 nm.
17. The method of claim 16 wherein the temperature is less than about 400°C.
18. A collection of rare earth doped metal/ metalloid sulfide particles having an average particle size from about 15 nm to about 500 nm.
19. The collection of particle of claim 18 comprising ZnS .
20. The collection of particles of claim 18 wherein the particles comprise no more than about 10 mole percent rare earth metal relative to the total metal composition.